

ANALYZING THE CONSERVATION BENEFITS OF USDA NRCS AGRICULTURAL LAND EASEMENTS

American Farmland Trust (AFT) compared a suite of conservation benefits provided by US Department of Agriculture Natural Resources Conservation Service (NRCS) program easements that protect agricultural land across the contiguous U.S. to non-easement agricultural land. The analysis focused on agricultural land easements with publicly available boundary data in the Agricultural Conservation Easement Program and Regional Conservation Partnership Program, along with easements from two predecessor programs, the Farm and Ranch Lands Protection Program and the Grassland Reserve Program.

The results show that the lands protected by these programs are of higher quality for agricultural production, are likely to store more carbon in their soils, and are in areas of higher biodiversity value than agricultural lands not under easement in the same counties.

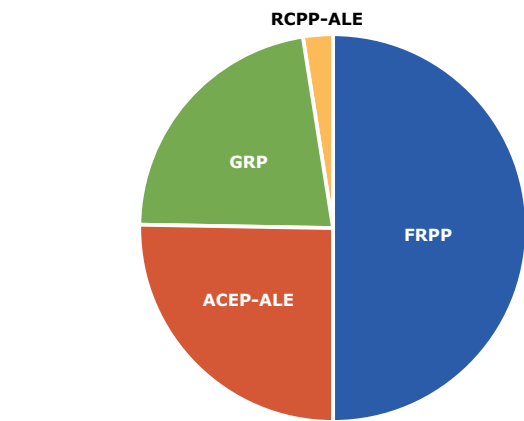
The following sections briefly outline the Programs assessed and the results of this analysis.

THE USDA NRCS AGRICULTURAL CONSERVATION EASEMENTS

NRCS works with farmers and ranchers to help improve and protect their soil, water, and other natural resources. One of the key accomplishments of NRCS easement programs is the over 2.2 million acres of agricultural lands that have been permanently protected from conversion to non-agricultural uses through several voluntary conservation programs that NRCS administers. These programs include the Farm and Ranch Lands Protection Program (FRPP), Grasslands Reserve Program (GRP), Agricultural Conservation Easement Program—Agricultural Land Easements (ACEP-ALE) and the Regional Conservation Partnership Program—Agricultural Land Easements (RCPP-ALE).¹ These programs provide cost-share to state and local governments, land trusts, and tribes toward the purchase of permanent or maximum-extent allowed by state law conservation easements to protect agricultural land from development.

To analyze the conservation benefits of the NRCS easements, AFT’s Protected Agricultural Land Database

Figure 1. Breakdown of analyzed easements²



- **FRPP:** 865,823 acres (4,033 easements)
- **ACEP-ALE:** 440,218 acres (737 easements)
- **GRP:** 382,837 acres (639 easements)
- **RCPP-ALE:** 42,640 acres (79 easements)

(PALD) acquired boundary data from publicly available sources for nearly 1.7 million acres of the over 2.2 million acres of land protected through FRPP, GRP, ACEP-ALE, and RCPP-ALE program easements nationwide³ (Figure 1). The analyzed easements represent a subset of the NRCS agricultural land easements as boundary data for some easements was not publicly available at the time of this study. In addition, AFT only included easements in the contiguous U.S. (CONUS) as some of the datasets needed to assess conservation benefits did not cover Alaska, Hawaii, or U.S. territories. The resulting analysis covers about 89% of the agricultural land easements (77% of total acres) in these programs as of August 7, 2023.

QUANTIFYING BENEFITS

Federal agricultural land easements protect the agricultural viability and related conservation values of eligible land by limiting nonagricultural uses. To be eligible, land must be

privately-owned or tribal agricultural land on a farm or ranch and must meet one of the four eligibility categories:

- Contains at least 50% prime, unique, or other productive soil,
- Contains historical or archaeological resources,
- Protects grazing uses and related conservation values, or
- Furthers a state or local government policy consistent with the purposes of ACEP.

Eligible land must also be cropland, pastureland, rangeland, grassland, or other grazing land, and/or nonindustrial private forest land that contributes to the economic viability of the parcel or serves as a buffer from development. Two other factors are important in eligibility: the land should have access to markets, infrastructure, and other agricultural support services; and the land is experiencing development pressure.⁴

A survey sent by AFT’s Farmland Information Center in 2022 to landowners participating in the FRPP program (a predecessor program to ACEP-ALE) confirms that federal agricultural land easements protect agricultural viability.⁵ Owners of lands protected through FRPP report using at least 78% of their protected land for agricultural production (i.e., cropland and permanent pasture or rangeland), and 79% of first-generation and 60% of second-generation owners credit the protected status of the land for improving the viability of their operations.⁶ The FRPP landowners reported that 39% of their protected land was cropland, 38% was permanent pasture or rangeland and 11% was woodland.⁷ Most of cropland and woodland acres were in the Northeast while most of the pasture and rangeland acres were in the West.

Furthermore, the protected status of these lands provides both security and motivation for landowners to implement additional conservation practices on their land.⁸ Use of these practices help protect and provide public benefits including mitigating climate change and providing wildlife habitat. Researchers have also identified additional co-benefits from protecting agricultural lands including providing pollinator habitat, erosion control, flood mitigation, groundwater and surface water recharge, scenic vistas, and recreational opportunities.⁹

THE AFT ANALYSIS

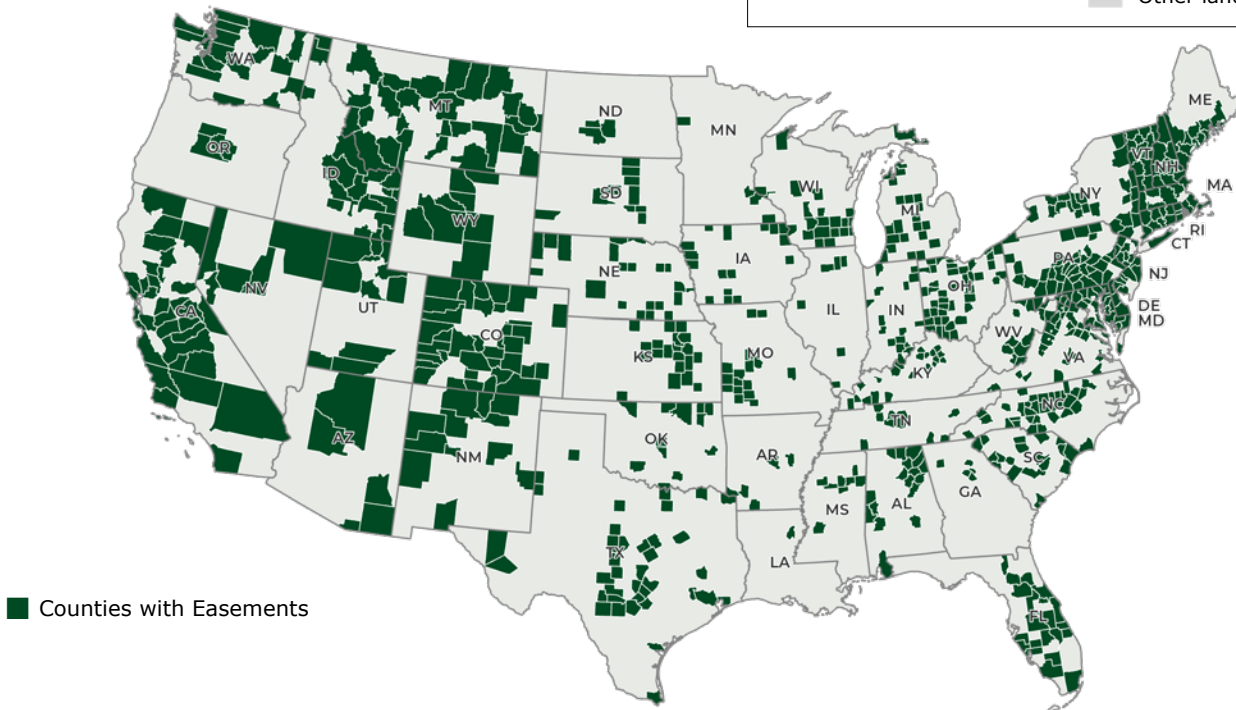
In this work, AFT used geospatial analyses to assess a selection of critical conservation benefits for the NRCS agricultural land easements in the contiguous U.S. for which boundary data could be acquired. In total, AFT assessed 5,488 easements or roughly 89% of NRCS easements in the programs considered, in 763 counties (Figure 2a). Lands

Figure 2b. Schematic shows agricultural lands protected by easements in relation to agricultural land without easements.



- County boundary
- Land **with** easement
- Agricultural land **without** easements
- Other lands

Figure 2a. Counties with Easements Included in Analysis



protected by the easements included in this study covered over 1.7 million acres. These lands were then compared to agricultural land not under easement in the 763 counties containing easements (Figure 2b). National results of this comparison are presented on a percent or per acre basis to account for the large difference in total acreage between land under easement and non-easement agricultural land in the counties considered.

The following sections present the results of this comparison between easement and non-easement land. Critical conservation benefits assessed in this study include several metrics related to the quality of agricultural land for crop production. In addition, AFT compares the potential for soil to sequester greenhouse gases in the form of current and future soil organic carbon. The strategic placement of easements near other blocks of protected land, proximity of easements to U.S. Census Urban Areas and amount of agricultural land transitioning to developed land use around easements are also summarized. Then, metrics for wildlife connectivity and habitat biodiversity are presented. Finally, the results section concludes with a summary of easement solar development suitability, compared to agricultural lands not under easement.

LAND QUALITY

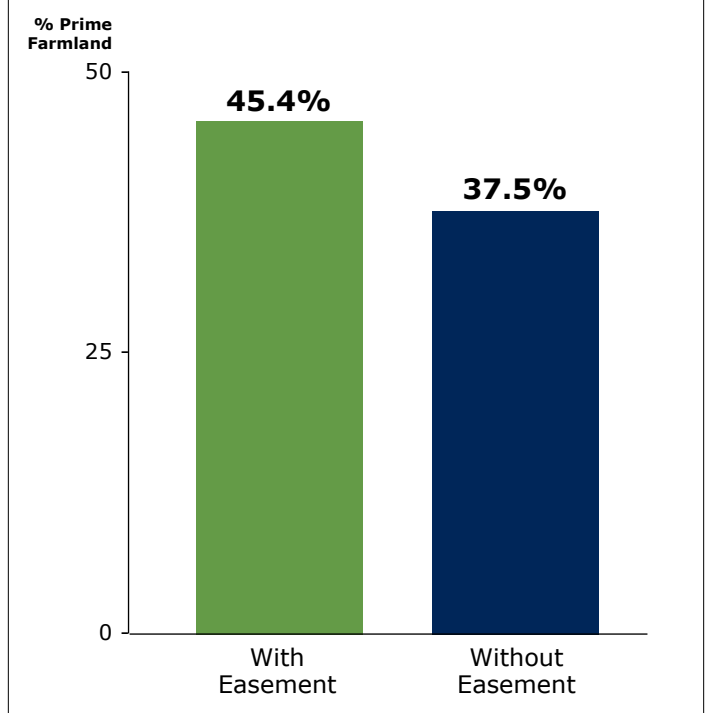
One of the four eligibility categories for NRCS agricultural land easements states that the land to be protected contains at least 50% prime, unique, or other productive soil. Land quality for agricultural production represents a critical ecosystem service and conservation benefit. When lands of higher quality are lost, cultivation may shift to lands of lower quality which can put more pressure on water, soils, and biodiversity.¹⁰ Protecting high quality agricultural land is a matter of food security and provides food and nutrition for the population.

AFT used three metrics to identify the quality of the lands under easement including: (1) the percent of prime farmland soils within an easement, (2) the mean value of the land's productivity, resiliency, and versatility (PVR) index (an AFT metric), and, (3) the percent of nationally significant land (a category derived from PVR that indicates land best suited for long-term crop production) within an easement. Overall, lands under easement were higher quality based on the above metrics than agricultural land not under easement. Note that land quality metrics may be emphasized in ranking criteria that determine the eligibility of an easement but may not be important for Grassland projects or policy projects.

Prime farmland

USDA defines prime farmland as having the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. For reference, slightly less than 23% of non-federal croplands, pastureland, rangeland, Conservation Reserve Program (CRP) lands, forest land, and other rural lands meet the criteria for prime farmland.¹¹ AFT used data from the USDA gridded Soil Survey Geographic Database (gSSURGO) to summarize the total

Figure 3. Percent area of lands classified as prime farmland



percent of area classified as “prime” for land under easement and for other agricultural land (Figure 3).

Overall, lands protected by the easements included in this study had nearly 8% more area classified as prime farmland than agricultural lands not under easement. Since prime farmland is land with some of the best characteristics for crop production, AFT focused on this category as a critical indicator of overall land quality in the context of agricultural production. AFT did not summarize the total percent of area classified as unique (land other than prime that is used to produce specific high value food and fiber crops), statewide important or locally important soils, but these are also important criteria that can be used to identify productive soils and could be included in future work.

Productivity, Versatility and Resiliency

The Productivity, Versatility and Resiliency (PVR) index, developed by AFT, is the first index of land quality that considers not only the land's productivity (P) but also its versatility (V) and resilience (R).¹² PVR is a measure of agricultural land suitability for long-term cultivation and food production. **To best support long term cultivation and food production, PVR values should be equal to or above 0.43.** For reference, the mean PVR value for croplands in the contiguous U.S. is 0.51, 0.33 for pastureland, 0.25 for woodlands, and 0.18 for rangelands.

Overall, the average PVR value for lands protected by the easements included in this study (0.47) was above this important threshold for long-term cultivation and food production, and below the threshold for lands without

Figure 4. Average agricultural land suitability for long-term cultivation and food production (PVR)

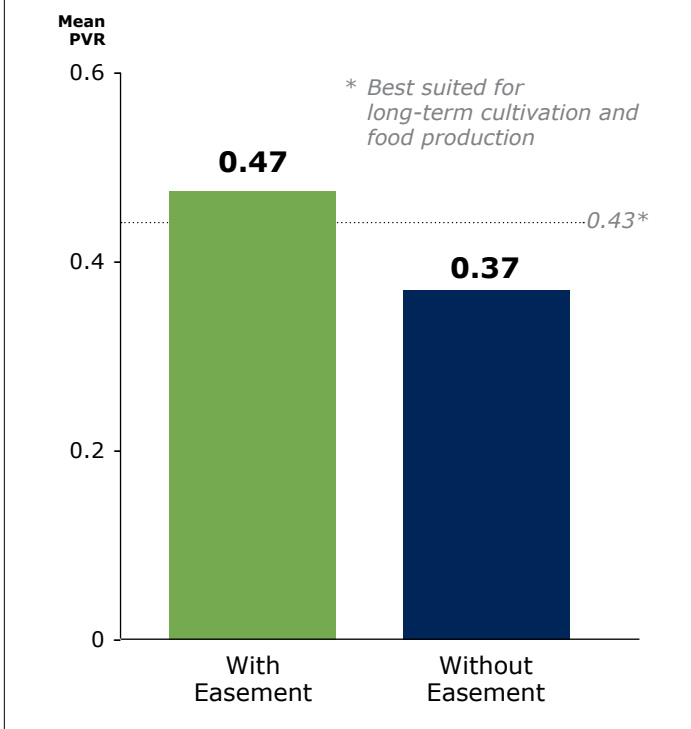
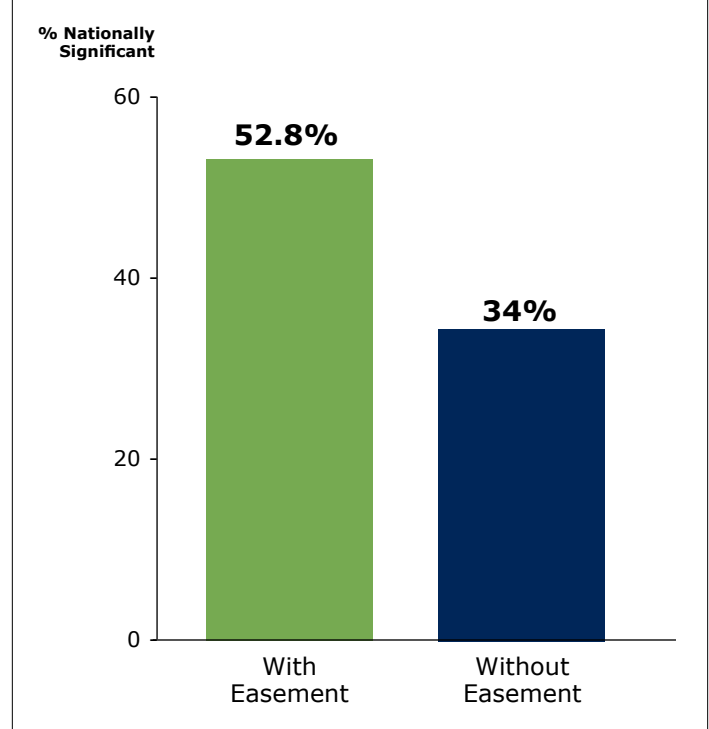


Figure 5. Percent area of lands classified as nationally significant



easements (0.37) (Figure 4). For additional reference, the mean PVR value for lands under easement includes a diversity of lower PVR land covers including pastureland, rangeland, and woodlands. Focusing the analysis only on cropland protected by easements would likely result in a higher PVR value than the results summarized here.

Nationally significant land

Nationally significant agricultural land is identified by AFT as land that is especially well-suited for long term cultivation and producing food based on nationwide PVR values.¹³ Nationally significant agricultural lands meet the following criteria: (1) contain soils that are prime, unique, or prime with limitations, (2) are active as cropland and pastureland producing relevant cropland types (fruits, vegetables, staple foods, grains), and (3) have a PVR value of 0.43 or higher. Overall, lands protected by the easements assessed here had nearly 19% more area classified as nationally significant than agricultural lands not under easement (Figure 5).

POTENTIAL TO REDUCE GREENHOUSE GAS EMISSIONS

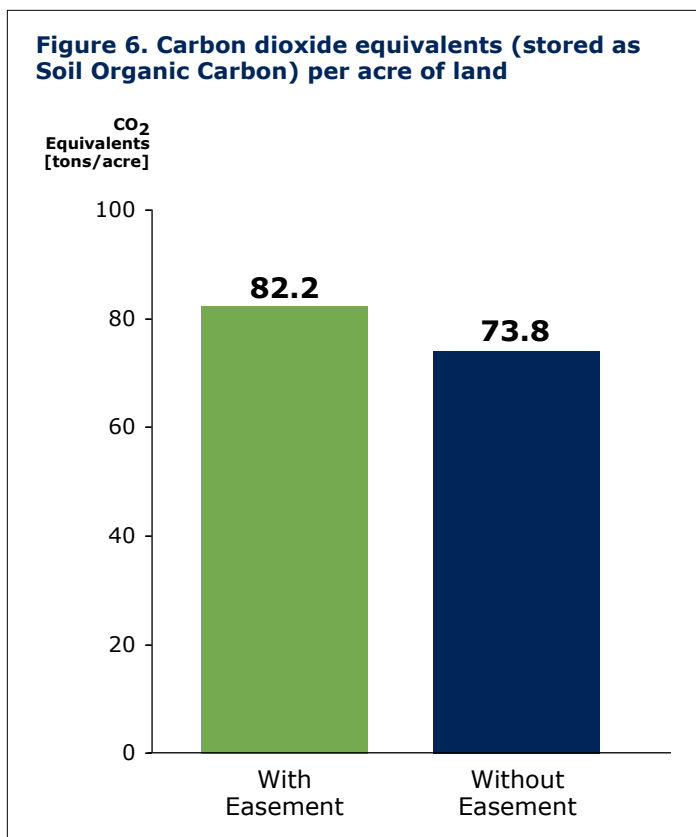
Plants and trees help remove carbon dioxide (CO₂), a notable greenhouse gas (GHG) that contributes to a changing climate, from the atmosphere. Some of this carbon is naturally retained in the soil and farmers can further increase carbon storage in the form of soil organic matter by employing tailored management practices to improve soil health.¹⁴ AFT used data from the [International Soil Reference and](#)

[Information Center \(ISRIC\)](#) and [Soils Revealed](#) to calculate both current and future soil organic carbon (SOC) based on estimates of current topsoil SOC and projected topsoil SOC under different cropland management scenarios. ISRIC provides a product called [SoilGrids™](#) that uses machine learning methods to map the distribution of soil properties across the globe. The [Soils Revealed](#) datasets begin with historic soil organic carbon stocks and predict future changes using an implementation of the [International Panel on Climate Change](#) management scenarios. For reporting purposes, the summarized SOC values from these datasets were then converted to carbon dioxide equivalents (CO₂e).

Overall, the soil carbon datasets AFT summarized suggest that land protected by easements stored 8.4 more tons of CO₂e per acre than non-easement agricultural land (Figure 6). While the mechanism behind this difference merits future study, possible reasons may be that easements are protecting soils with higher initial SOC, that practices employed on these easements better maintain SOC, and that easements lands protect a diversity of land covers and uses that lead to increased SOC. Further study is needed to better understand the reasons for this difference.

When conservation practices are considered, lands managed by easement landowners may store even more carbon than agricultural lands not under easement, since the likelihood that conservation practices are implemented has been found to be higher on easement lands.¹⁵ For example, the FRPP landowners surveyed most frequently adopt conservation practices that are directly related to global carbon cycling (63% adopted conservation tillage, 59% stream buffers,

Figure 6. Carbon dioxide equivalents (stored as Soil Organic Carbon) per acre of land



57% cover crops, 59% nutrient management strategies, and 39% rotational grazing). And almost 70% of the FRPP landowners are extremely or very interested in improving soil health, which rebuilds carbon stocks in the soil.¹⁶ Using the SoilsRevealed datasets, which represent additional SOC that could be stored in cropland soils by 2038 when employing selected soil health management practices like cover crops and no-till, suggests that implementing these practices on cropland could store additional CO₂e (Table 1). As the SoilsRevealed datasets focused only on cropland, the difference between additional CO₂e stored on easements compared to agricultural land not under the easement is striking. The reason for these differences also merits more focused research but could be because cropland under easement is cultivated on higher quality soils (in terms of

SOC) to start with, or that initial SOC stocks were higher due to soil health practices that been implemented at a higher frequency or intensity on easements than on land not under easement.

STRATEGIC PLACEMENT

NRCS easements are purposely located next to (1) other protected lands and (2) rapidly expanding developed areas to increase the strategic value of agricultural land protection for growing communities. AFT’s assessment highlights this strategic placement.

Proximity to other protected land

Protecting agricultural lands next to other protected lands (both working lands and natural lands) helps to (1) protect a strategic block of agricultural land that can support agricultural viability in the community,¹⁷ (2) buffer permanently protected natural areas,¹⁸ (3) provide corridors for wildlife movement,¹⁹ and (4) redirect any subsequent development into already developed areas, reducing future GHG emissions among other conservation benefits.²⁰ Data from the National Conservation Easement Database, the Protected Areas Database of the United States 3.0 (PAD-US), and AFT’s PALD was combined into a single protected lands data layer representing both working and natural protected lands to determine the proximity of the easements analyzed in this study to other protected lands:

- **87.6% of the analyzed easements analyzed** (n = 4,808) are within **1 mile** of other protected areas (both working and natural lands), and over **2.8 million acres** of other protected lands are within 1 mile of the easements AFT assessed.

Proximity to developed land

While not a conservation benefit, protecting farmland directly in the path of development helps to prevent agricultural lands from being converted to non-agricultural uses.²¹ For example, 90% of first generation FRPP landowners reported that they placed an agricultural conservation easement on their land to protect the parcel from development.²² AFT used data

Table 1. Estimated additional tons of Carbon Dioxide Equivalents (CO₂e) stored in 2038 as Soil Organic Carbon on croplands with the addition of high organic inputs, minimal soil disturbance, or a combination*

Additional Carbon Dioxide Equivalents (CO ₂ e) sequestered in Cropland Soils under selected management practices (2038)		
Management Practice	With Easements (Tons CO ₂ e/acre)	Without Easement (Tons CO ₂ e/acre)
High organic inputs**	+6.13	+2.1
Minimal disturbance**	+8.81	+3.2
High organic inputs and minimal disturbance**	+15.85	+5.6

* Carbon dioxide equivalents are the global warming potential weighting of emissions (Bruner et al. 2020). To convert from tons of carbon sequestered (soil organic carbon) to CO₂e, multiply by 3.67 (the ration of the molecular weight of carbon dioxide to the molecular weight of carbon or 44:12).

** **Organic inputs** = cover crops and green manures or other higher residue return practices on all cropland areas; **minimal disturbance** = no-till on all cropland areas; estimates additional CO₂e removed from the air by 2038 by these practices.

from its *Farms Under Threat* analysis to identify developed land uses that were within 1 mile of NRCS easements. AFT summarized and combined two types of lands that increased developed land use between 2001 and 2016 using its urban and highly developed (UHD) and low density residential (LDR) data layers.²³

- **62%** of analyzed easements are within 1 mile of agricultural lands that had been converted to developed land use.
- **157,150 total acres** of agricultural land within 1 mile of the easements included in this analysis were converted to developed land use (UHD or LDR).
- **43 acres**, on average, of agricultural land within 1 mile of the easements included in this analysis were converted to more developed land use.
- **71% of the easements analyzed** (n = 3,875) are in counties where the total acreage of agricultural land converted to more developed land use (2001–2016) was higher than the state median.
- **56% of easements analyzed** (n = 3,073) are in counties where proportional agricultural conversion (a county’s total % of agricultural land converted to more developed land use) is higher than the state median.

Distance to urban clusters/markets

Easements in this analysis are an average of **7.24 miles** from U.S. Census Urban Areas. This is important because 15% of FRPP landowners report diversifying their marketing options by selling produce directly to consumers, while 36% report either adding processing facilities, installing a greenhouse or high tunnel, diversifying marketing options by selling produce to intermediaries, or installing retail facilities.²⁴ Eating locally grown fruits and vegetables can reduce food system GHG emissions from transportation,²⁵ further adding value to lands that are protected from development and maintained as part of the local food production system.

WILDLIFE HABITAT/MOVEMENT AND BIODIVERSITY

A large majority (over 87%) of easements in this assessment are near other protected lands. Many of these protected lands are in recognized biodiversity areas and play a critical role in supporting the movement of wildlife and providing suitable habitat corridors.

Wildlife habitat & movement

To quantify the impact of agricultural lands on the movement of wildlife, AFT incorporated estimates of agricultural management intensity into a computer model to create an index that measures the unimpeded movements of species (known as ecological flow connectivity).²⁶ Collectively, the land easements assessed in this study had an average value of movement score of **130**, supporting more wildlife movement than cropland alone (91.1) but less than woodland (169.6) or rangeland (226.6). Agricultural lands without

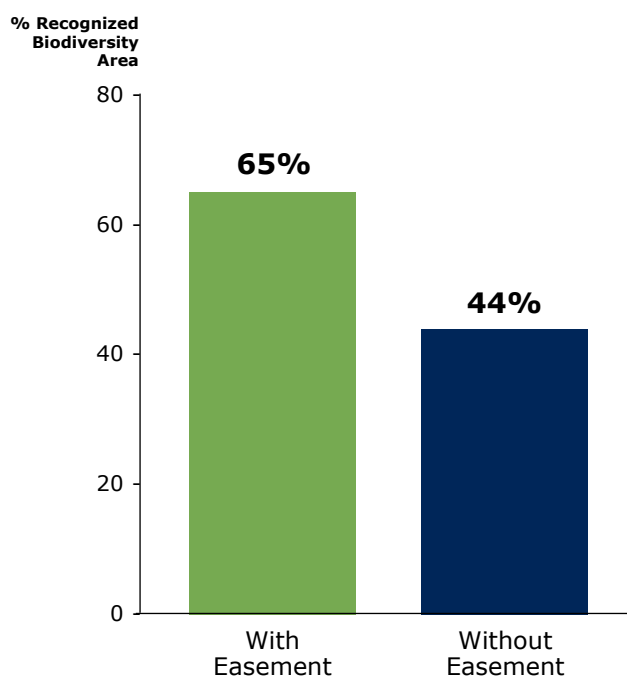
easements averaged **128**. The least impeded areas for wildlife movement were natural or protected areas with an average movement score between 378.5 and 401.2. In contrast, the average movement score for high density development was 59.5 on the index used to measure species movement.

Wildlife movement and habitat suitability across properties can improve with conservation practices implemented by landowners. FRPP landowners reported that they implemented many wildlife friendly conservation practices since placing easements on their properties. For example, the FRPP landowners report using buffers along streams or field edges (59%), grassed waterways (37%), integrated pest management (34%), fish and wildlife practices (24%), and in-field buffer strips (20%).²⁷

Recognized biodiversity value

Recognized Biodiversity Areas (RBAs) are lands that include rare species, intact habitat, exemplary natural communities, and represent conservation opportunity areas.²⁸ Since easements are often placed near other protected lands, and protected lands are often selected for their biodiversity, wildlife friendly conservation practices on agricultural land easements, such as those reported by FRPP landowners,²⁹ are well positioned to enhance and protect the biodiversity harbored within agricultural landscapes and neighboring nature reserves. Overall, lands protected by the easements included in this study had nearly 21% more area classified as a Recognized Biodiversity Area than agricultural lands without an easement (Figure 7).

Figure 7. The percentage of total easement area classified as a Recognized Biodiversity Area compared to agricultural lands without an easement



SOLAR SUITABILITY

Suitability for solar installations

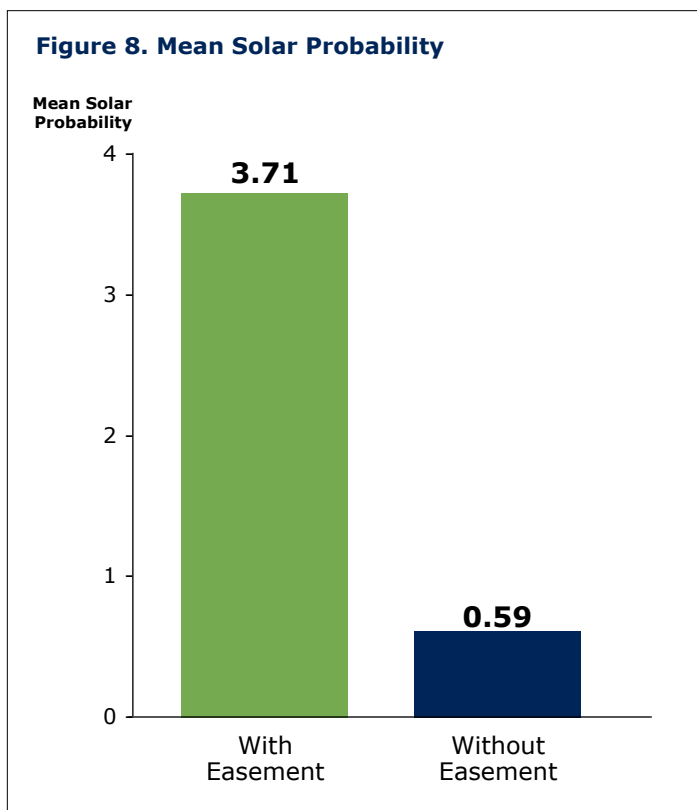
Solar energy development on agricultural lands continues to expand rapidly. This can include small solar developments for on-farm use, which are allowed under ACEP-ALE easements to support on-farm energy uses, and can also include large-scale industrial energy developments, which are not.

AFT supports smart solar siting,³⁰ and, to help plan for the future, developed a solar development suitability layer based on elevation, slope, proximity to existing transmission infrastructure, proximity to urban and populated areas, and limits to solar development and projected the likelihood of solar development on the landscape to 2040.³¹ AFT did not include land cost or soil quality as solar suitability

characteristics since they are minor factors in the economics of solar energy development compared to other variables. Lands with high suitability for solar development can support alternative energy for on-farm uses, and these lands are also at high risk for conversion to industrial-scale solar.

AFT assessed the relative suitability of easement versus non-easement lands in terms of suitability for solar development and found that the average suitability for lands with easements was more than 6 times higher than agricultural lands without easements (Figure 8). The higher suitability for solar development could be important for easement holders since the NRCS easements allow renewable energy production that covers the needs of the protected property. Any renewable energy sources must be built and maintained within impervious surface limits within the building envelope and consistent with the purpose of the land protection program.

Also, the higher suitability values on the easements included in this study imply that these lands were at risk of being converted to large-scale solar installations, thus reinforcing the value of easements for keeping the highest quality agricultural lands in production.



FULFILLING THEIR PROMISE

The purposes of ACEP are to restore, protect, and enhance wetlands on eligible land; protect the agricultural viability and related conservation values of eligible land by limiting nonagricultural uses of that land that negatively affect the agricultural uses and conservation values; and protect grazing uses and related conservation values by restoring or conserving eligible land.³² AFT analyzed the agricultural land easements component of ACEP and the metrics used confirm that these easements are fulfilling the promise of related conservation values. The metrics show that these lands have soils of higher quality for agricultural production, store more carbon in their soils, and are in areas of higher biodiversity value where blocks of protected land can be critical to facilitate wildlife movement and biodiversity nationwide.

ENDNOTES

1 The Agricultural Conservation Easement Program (ACEP), introduced in 2014, consolidated three previously separate easement programs—the Wetlands Reserve Program (WRP), Grassland Reserve Program (GRP) and the Farm and Ranch Lands Protection Program (FRPP). ACEP has two components: Agricultural Land Easements (ALE) and Wetlands Reserve Easements. WRP easements were not included in the AFT analysis. The Regional Conservation Partnership Program (RCPP) is a voluntary collaborative conservation program which enables NRCS to work with eligible partners to implement conservation activities (easements) on the land.

As of August 7, 2023, NRCS had 2,243,974 acres enrolled through ACEP-ALE, FRPP, GRP and RCPP-ALE (personal communication, Danielle Balduff, NRCS).

2 The AFT analysis includes about 89% of the agricultural land conservation easements in the NRCS programs as of August 7, 2023 (93% of the FRPP easements, 99.5% of GRP easements, 79% of ACEP/ALE easements and 50% of RCPP-ALE easements) (personal communication, Danielle Balduff, NRCS).

3 For an overview and updated data on the NRCS conservation easement programs, see: <https://www.farmers.gov/data/easements-overview>.

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